emitted as yellow. A red-lined copy of FIG. 6 is attached showing that the yellow light comes from the downconverting material. A new formal drawing will be submitted upon approval of the examiner.

Claims

Objections

37 C.F.R. 1.75(c)

Claim 37 was objected to under 37 C.F.R. 1.75(c), as being of improper dependant form for failing to further limit the subject matter of a previous claim. As noted by the examiner, claim 30 states in part (including language from as amended herein):

> . . . said plurality of active layers arranged vertically on said substrate with a plurality of doped semiconductor layers with each of said active layers sandwiched between two doped layers, said substrate absorbing at least some of said light from at least one of said plurality of active layers and re-emitting omnidirectional light at a different wavelength.

Claim 37 was intended to further limit claim 30 by including limitations that the active layers can selectively emit light so that the LED emits only light from the active layers or emits light from the active layers in combination with the light from the substrate. Applicants submit that this language does further limit the limitation of "a means for selectively causing said plurality of active layers to emit light omnidirectionally alone or in combination with others of said plurality of active layer" by including additional limitations on how the LED operates when different active layers emit light.

To clarify this limitation, claim 37 has been amended to include, "said means for causing each of said plurality of active layers to emit omnidirectional light being capable of causing different ones of the active layers to emit omnidirectional light such that . . ." The remainder of the claim includes the two options that are further limitations to the means element of claim 30. Applicants submit that claim 37 does further limit claim 30.

Claim 55 was objected to because of a clerical error and has been corrected the change the word "on" to "one", as suggested by the examiner.

Rejections

35 U.S.C. 112

Claims 30-47, 54 and 55 were rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which is most closely connected, to use the invention. The examiner noted the language in claim 30, "a means for selectively causing each of said plurality of active layers to emit omnidirectional light alone or in combination with others of said plurality of active layers" and correctly presumed that this claim reads on the embodiment of FIG.2 (among other embodiments shown in the present application and otherwise covered by the inventive concepts in the present application).

The examiner concluded that the claims are enabled for producing one color of light (UV=> red) when contacts 29 and 31 are biased, but the specification does not reasonably provide for selectively causing each of the

active layers to emit. The examiner found that in stacked active layer LEDs carriers flow between the n-contact and the particularly chosen p-contact causing emission of all intervening layers. Accordingly, it is the examiner's opinion that if a bias is applied between for instance, contacts 31 and 27, carriers will flow between the contacts causing light emission from all three active layers 21-23 thereby producing green, blue and red light.

The examiner's comments have been studied carefully and applicants submit that the examiner's explanation of how the disclosed device operates is not correct in the context of devices made of certain materials, such as nitride base devices. Because of the heavy hole mass in nitride based (e.g. Gallium Nitride) devices, the active layer closest to the p-contact traps the majority of the hole population, emits the majority of the light, and dominates the wavelength of emitted light. Removing the bias from the p-contacts 28 and 31, and biasing the p-contact 29, allows active layer 22 to dominate the emission spectrum because it is closest to the biased contact. Removing the bias from the contacts 28 and 29, and applying a bias to contact 31, allows the active layer 23 to dominate the emission spectrum. Accordingly, the LED can selectively emit green, blue or red light by selectively applying a bias to one of the contacts 27, 28 and 29. To further emphasize these operating features, claim 30 has been amended to show that it is a nitride based device.

The examiner also rejected claims 41-44 because the specification as originally filed did not disclose a plurality of active layers that emit one color of light in combination with the limitation of a means for selectively causing each of said plurality of active layers to emit

omnidirectional light alone or in combination with others of said plurality of active layers. Each of these claims have been amended in independent form with the objected to limitation deleted such that the device as claimed comprises an active layer surrounded by oppositely doped layers.

35 U.S.C 102(b)

Claims 5-7, 14, 16, and 25-28 were rejected as being anticipated by JP '203. The examiner provided a *Derwent* computer translation of this reference with his office action, but applicants' found the translation difficult to follow leaving the true scope of the reference unclear. Applicants had relevant portions of the reference translated by a professional translating service and a copy of the translation is attached for the examiner's reference. Applicants will discuss the JP '203 reference and then address the rejected claims.

JP '203

The subject matter of the JP'203 reference is similar to the subject matter of the present application, but applicants submit that it does not provide sufficient details to anticipate the rejected claims.

JP '203 initially discusses LED 1 (FIG. 1) as comprising a substrate 2 and a semiconductor light emitting element 3 formed on the substrate 2. The substrate comprises a material that converts the wavelength of light from the light emitting element 3. This material is described as a "light-emission center element" added to the substrate base material as an element that, when uniformly distributed throughout the base, emits light of the color red, green or blue when exposed to light (UV) from the

light emitting element 3. By changing the light-emission center element in substrate 2, red, green and blue light emitting elements can be readily manufactured. There is a vague mention of another LED that is arranged "By providing a given substrate with a multitude of light-emitting units comprising substrate regions that emit light of the color red, green or blue, by means of light generated by a semiconductor light emitting element, it is possible to produce a display for color display."

FIG. 2 shows a similar emitter 10 wherein a bias is applied to the emitter across the uppermost electrode layer 17 and the transparent electrode layer 13. FIG. 3 shows a similar emitter 20 wherein a bias is applied across contacts 29 and 30 to cause the emitter to emit light. Under discussions of this embodiment is again mentioned, "Alternatively, a given substrate may be provided with a large number of light-emitting regions for red, green and blue colors to produce a display for color display. FIG. 4 is an embodiment similar to the emitter 20 in FIG. 3, except that it includes a reflective layer 31.

Under the Effects of the Invention it is again noted that, "By providing a given substrate with a multitude of light-emitting units comprising substrate regions that emit light of the color red, green, or blue, by means of light generated by a semiconductor light emitting element it is possible to produce a display for color display." However, this reference fails to disclose any detail on **how** this arrangement would be realized or how it would work. There is no mention of how the emitter would or could be made or controlled such that it would emit the different colors of light. There are no figures showing these embodiments, only a brief statement of what is "possible". There is simply not sufficient to qualify as an enabling disclosure of the

"color display" embodiment.

Applicants submit that JP '203 fails to disclose sufficient details on the color displays mentioned, such that it could not anticipate the rejected claims. For a reference to anticipate a claim, it must teach every aspect of the claimed invention either explicitly or impliedly. MPEP § 706.02. "[A] § 102(b) reference must sufficiently describe the claimed invention to have placed the public in possession of it . . . [E]ven if the claimed invention is disclosed in a printed publication, that disclosure will not suffice as prior art if it was not enabling." Paperless Accounting, Inc. v. Bay Area Rapid Transit Sys. 804 F.2d 659, 665, 231 USPQ 649, 653 (Fed.Cir, 1986). "An enabling disclosure is not 'tossing out the mere germ of an idea' but the provision of 'reasonable detail . . . in order to enable members of the public to understand and carry out the invention." United States Filter Corp. v. Ionics Inc., 68 F.Supp.2d 48, 65, 53 USPQ2d 1071, 1085 (D.Mass 1999).

JP '203 fails to provide the sufficient enabling disclosure such that members of the public could understand and carry out the "possible" color display embodiments and cannot anticipate the rejected claims. In fact, it provides no details whatsoever.

Rejected Claims

Claim 14 and 25 are allowable over the JP '203 reference because is fails to provide the required enabling disclosure. Claim 14 is an independent claim from which claims 5-7 and 16 depend, and claim 25 is an independent claim from which claims 26-28 depend. The dependant claims are also allowable as depending from an allowable

independent claim.

Claim 14 has been amended to further distinguish it from JP '203, and now includes the limitations that the substrate is "doped throughout with a plurality of impurities such that said impurities simultaneously absorb the light of said active layer and each re-emits more than one color of light." JP '203 only mentions the use of impurities in different regions, but does not disclose, teach of suggest the use of multiple impurities throughout the substrate that simultaneously absorb light from the active layer and re-emit light. This claim is allowable over JP '203 and depending claims 5-7 are also allowable.

Claim 16 has been amended in independent form to now include most of the limitations of claim 14 and the additional limitations that "the emission of said active layer being controllable such that said active layer can emit primarily over a selected one or more of said color centers." JP '203 does not mention, disclose, teach or suggest the limitations of this claim and it is allowable. Claims 52 and 53 depend from claim 16 and are also allowable.

Claim 25 has been amended to include limitations similar to this in amended claim 16 and it is now allowable. Claims 26-28 depend from allowable claim 25 and are allowable.

35 U.S.C. § 103

JP '203

The examiner rejected claims 4, 24, and 29 as being unpatentable (obvious) over JP '203 as applied to the claims above. Claims 4 and 24 depend from allowable claim

independent claim.

Claim 14 has been further amended to further distinguish it from JP '203, and now includes the limitations that the substrate is "doped throughout with a plurality of impurities such that said impurities simultaneously absorb the light of said active layer and each re-emits more than one color of light." JP '203 only mentions the use of impurities in different regions, but does not disclose, teach of suggest the use of multiple impurities throughout the substrate that simultaneously absorb light from the active layer and re-emit light. This claim is allowable over JP '203 and depending claims 5-7 are also allowable.

Claim 16 has been amended in independent form to now include most of the limitations of claim 14 and the additional limitations that "the emission of said active layer being controllable such that said active layer can emit primarily over a selected one or more of said color centers." JP '203 does not mention, disclose, teach or suggest the limitations of this claim and it is allowable. Claims 52 and 53 depend from claim 16 and are also allowable.

Claim 25 has been amended to include limitations similar to this in amended claim 16 and it is now allowable. Claims 26-28 depend from allowable claim 25 and are allowable.

35 U.S.C. § 103

JP '203

The examiner rejected claims 4, 24, and 29 as being unpatentable (obvious) over JP '203 as applied to the claims above. Claims 4 and 24 depend from allowable claim

14 and are also allowable. Claim 29 depends from allowable claim, and is also allowable.

Kaneko '901 in view of JP '203

Claims 4-7, 9, 14-16, 24-29 were rejected as being unpatentable over Kaneko '901 in view of JP' 203 as applied to the claims above. As fully discussed above, JP '203 lacks sufficient enabling disclosure to anticipate the claims rejected above and accordingly lacks sufficient enabling disclosure to be combined with Kaneko '901. Kaneko '901 cannot be relied upon alone to render these claims obvious because, as correctly noted by the examiner, the embodiments in Kaneko '901 use mirrors to produce directional, coherent emission of the secondary light produced in the substrate. Kaneko '901 focuses on using a light source to pump a solid state laser, which includes and optical crystal and mirrors.

Applicants submit that the devices disclosed in Kaneko'901 cannot be combined with the non-enabling disclosure of JP '203 to produce the claimed invention. Further, the examiner did not cite a disclosure or suggestion that these references be so combined. "It is impermissible to use the claimed invention to serve as an instruction manual or template to piece together the teachings of the prior art so that the claimed invention is rendered obvious." In re Fritch, 23 U.S.P.Q.2d 1780 (Fed. Cir. 1992). "The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification." In re Gordon, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984).

Further, claims 14 and 25 have been amended to distinguish them over the prior are, and these new

limitation are not disclosed, taught or suggested by either Kaneko '901 or JP'203. Claims 4-7, 15, 16, and 24 depend from claim 14 and are also allowable. Similarly, claims 26-29 depend from claim 25 and are also allowable.

JP '203 in view of Bojarczuk

Claims 40-44, 47, 52, and 47 were rejected as being unpatentable over JP '203 or alternatively JP '203/Kanekp as applied to the claims above, and further in view of Bojarczuk Jr. et al. '185 ("Bojarczuk '185). The examiner noted that JP '203 teaches that the recombination-center-doped substrate can be employed in a RGB display (with color centers). As outlined in detail above, JP '203 does not include sufficient enabling detail and cannot be characterized as providing of "teaching" of this subject matter. Applicants submit that JP '203 should not be relied upon under this section to find that the rejected claims are obvious.

Claim 30 is the independent claim from which claim 40 depends. In rejecting claim 40 the examiner relied on FIG. 8 of Bojarczuk '185, which essentially shows three parallel arranged LEDs on a sapphire substrate 72 with red, green and blue dyes 94, 96, 98 deposited on the surface of the substrate 72 opposite the LEDs. A channel is included between the LEDs such that the active layer are horizontally arranged adjacent to one another and do not touch.

In claim 30, the active layers are "stacked" a limitation that is not disclosed or taught by Bojarczuk '185. Claim 30 has also been amended to include limitations directed to doped layers also stacked on the substrate to that each of the active layers is sandwiched between a doped layer. This limitation is not disclosed, taught or

suggest by Bojarczuk '185 or JP '203 alone or in combination.

Claim 40 and 47 depend from claim 30 and are allowable of these references. Regarding claim 40, the examiner noted that Nichia has been combining blue and yellow light since the mid 1990s and apparently concluded that the Nichia approach (as described in the Background of the application) would render the claim obvious. However, the Nichia approach utilizes a downconverting material around a blue emitting LED, with at least some of the blue light converted to yellow by the downconverting material. The structure of claim 40 is quite different and claims active layer emitting blue and yellow light with some of the yellow light converted to red light in the doped substrate. The Nichia device does emit yellow and blue light, but is completely different from applicants claimed device.

Claims 41, 42, and 43 have been amended in independent form as discussed above and include limitations not disclosed, taught or suggested by these references. Claim 41 includes the limitation that the substrate is doped "throughout" with impurities. Claim 42 includes the limitation that the substrate throughout with specific elements. Claim 43 includes the limitations that the color centers that absorb UV light and re-emit a different color of light. These claims are allowable over these references. Claim 44 depends from allowable claim 43 and is also allowable.

Claims 52 and 53 depend from allowable claim 16 (as discussed above) and are also allowable.

JP' 203 in view of McIntosh '309

Claims 30, 31, 33-42, 54 and 55 were rejected as being

unpatentable over JP '203 or JP '203/Kaneko as applied to the claims above and further in view of McIntosh '309. Again, JP '203 does not include sufficient enabling detail and cannot be characterized as providing of "teaching" of this subject matter. Applicants submit that JP '203 should not be relied upon under this section to find that the rejected claims are obvious.

Further, McIntosh does not disclose, teach or suggest having a substrate that is doped to absorb light from the active layers to emit another wavelength of light. Instead, discloses an emitter having two active layers stacked on a substrate that claim to emit a white light combination of light from the active layers. It discloses another emitter having three active layers that claim to emit a white light combination of light. Different embodiments are shown where the individual ohmic contacts are provided so that the active layers can vary in intensity as a function of the individual biases.

Further, JP '203 does not disclose, teach or suggest an LED with multiple active layers stacked on a doped substrate. The examiner has not provided a reference that teaches or suggests that these references could or should be combined.

Claims 31 and 33-40 depend from allowable claim 30 and are also allowable. Further, claim 38-40 contain specific embodiments of the invention that are not taught or disclosed by the invention. The cited references do not even mention these specific embodiments.

All of the claims in the application are now believed to be in proper form for allowance, and a Notice of Allowance is respectfully requested.

A petition for a two month extension of time to file

this response is filed concurrently.

Respectfully submitted,

April 21, 2003

Jaye G. Heybl
Attorney for Applicants
Registration No. 42,661

KOPPEL JACOBS PATRICK & HEYBL
555 St. Charles Drive, Suite #107
Thousand Oaks, CA 91360
(805)373-0060

VERSION WITH MARKINGS TO SHOW CHANGES MADE

14. (Twice Amended) A light emitting diode (LED), comprising:

an active region;

a pair of oppositely doped layers on opposite sides of said active layer which cause said active region to emit light at a predetermined wavelength in response to an electrical bias across said doped layers; and

a doped substrate, said active region and doped layers disposed successively on said substrate such that said substrate absorbs at least some of said light from said active region, said substrate doped throughout with a plurality of impurities such that [it absorbs] said impurities simultaneously absorb the light of said active layer and each re-emits more than one color of light.

16. (Twice Amended) A light emitting diode (LED), comprising:

an active region;

a pair of oppositely doped layers on opposite sides of said active layer which cause said active region to emit light at a predetermined wavelength in response to an electrical bias across said doped layers; and

a doped substrate, said active region and doped layers disposed successively on said substrate such that said substrate absorbs at least some of said light from said active region, said substrate doped with a plurality of impurities such that it absorbs the light of said active layer and re-emits more than one color of light [The LED of claim 14], wherein said active region emits UV light, and said substrate is doped by a plurality of rare earth or

transition elements in a plurality of separate color centers that each absorbs UV light and re-emits a different color of light, the emission of said active layer being controllable such that said active layer can emit primarily over a selected one or more of said color centers.

25. (Amended) A method for generating light from a solid state light emitting device, comprising:

providing a light emitting diode having an active layer surrounded by a pair of oppositely doped layers, all of which are disposed on a doped substrate that is doped with a plurality of impurities, each of which comprises a separate color center;

exciting an optical emission from said active layer within a first wavelength range;

selectively applying at least a portion of said optical emission to one or more of said separate impurity color centers to stimulate emission from said doped substrate within different wavelength ranges depending on said plurality of impurities color centers; and

transmitting a combination of said optical emission and substrate emission as said LED's light.

30. (Twice Amended) A nitride based light emitting diode, comprising:

a plurality of active layers each of which is capable of emitting light at a predetermined wavelength;

a means for selectively causing each of said plurality of active layers to emit light alone or in combination with others of said plurality of active layers; and

a doped substrate, said plurality of active layers arranged vertically on said substrate with a plurality of doped semiconductor layers with each of said active layers

sandwiched between two doped layers, [such that] said substrate [absorbs] absorbing at least some of said light from at least one of said plurality of active layers and [re-emits] re-emitting light at a different wavelength.

37. (Twice Amended) The LED of claim 30, wherein said means for causing each of said plurality of active layers to emit omnidirectional light being capable of causing different ones of the active layers to emit omnidirectional light such that the light emitting from said LED comprises the light emitting from at least one of said plurality of active layers or the light emitting from at least one of said plurality of active layers in combination with the light emitted from said doped substrate.

41. (Twice Amended) A light emitting diode, comprising:

an active layer;

a pair of oppositely doped layers on opposite sides of said active layer which cause said active layer to emit light at a predetermined wavelength in response to an electrical bias across said doped layers; and

a doped substrate, said active layer and doped layers arranged in a stack on said substrate, said substrate absorbing at least some of said light from said active layer and re-emitting light at a different wavelength, [The LED of claim 30], [wherein said plurality of active layers emit one color of light,] said substrate doped throughout with a plurality of impurities such that said substrate absorbs the light from said active layer, and re-emits more than one color of light.

42. (Twice Amended) A light emitting diode, comprising:

an active layer;

a pair of oppositely doped layers on opposite sides of said active layer which cause said active layer to emit light at a predetermined wavelength in response to an electrical bias across said doped layers; and

a doped substrate, said active layer and doped layer arranged in a stack on said substrate such that said substrate absorbs at least some of said light from said active layer and re-emits light at a different wavelength, [The LED of claim 30, wherein said plurality of active layers emit UV light] and wherein said substrate is doped throughout with chromium, titanium, and cobalt, said doped substrate absorbing said UV light and emitting red, green, and blue light.

43. (Twice Amended) A light emitting diode, comprising:

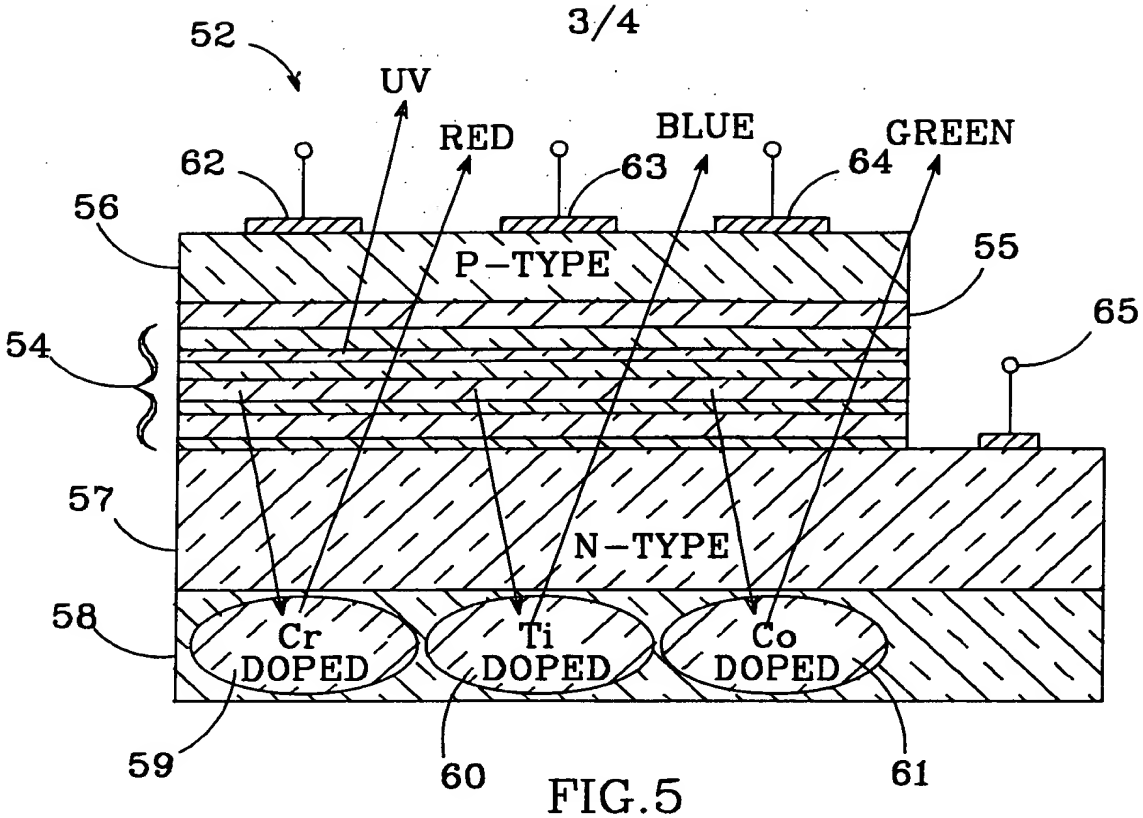
an active layer;

a pair of oppositely doped layers on opposite sides of said active layer which cause said active layer to emit light at a predetermined wavelength in response to an electrical bias across said doped layers; and

a doped substrate, said active layer and doped layer arranged in a stack on said substrate such that said substrate absorbs at least some of said light from said active layer and re-emits light at a different wavelength, [The LED of claim 30, wherein said plurality of active layers emit UV light,] and wherein said substrate is doped by one or more rare earth or transition element in a plurality of separate color centers each of which absorbs UV light and re-emits a different color of light.

55. (Amended) The LED of claim 54, wherein said means for causing each of said plurality of active layers to emit

light further comprises an n-type layer contact and a plurality of p-type layer contacts, said n-type layer contact contacting said n-type layer and each of said plurality of p-type contacts contacting a respective [on] one of said plurality of p-type layers.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BLUE
GREEN
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P-TYPE
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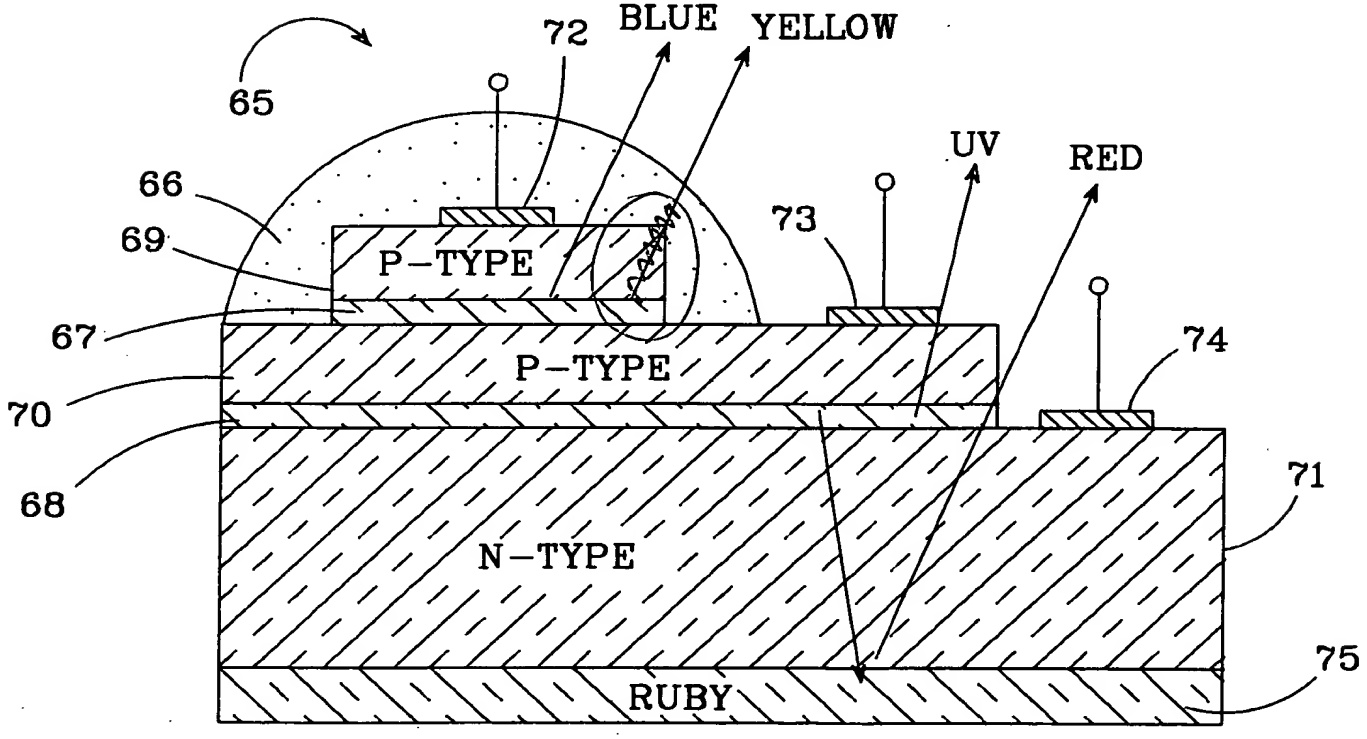
Co
DOPED
59
60
61

FIG.5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69
P-TYPE
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P-TYPE
74
70
68
71
N-TYPE
75
RUBY

FIG.6